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Inside Geopolitics of Energy

Another Day in the Desert: A Response to the Book, "Twilight in the Desert"

*by Jim Jarrell**

Background

We have reviewed *Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy*, written by Matthew Simmons, CEO of Simmons & Company International, a Houston-based investment bank that specializes in the energy industry. As independent petroleum engineers, we disagree with the primary conclusion of this book that Saudi Arabia's oil production is teetering on the brink of steep, irrevocable production decline. We believe the process used by the author to arrive at the conclusion was impaired by incorrect interpretation of reservoir engineering concepts and common oilfield operations. The book posits a crisis where in our opinion none exists.

The author, through a review of more than 200 Society of Petroleum Engineers (SPE) research papers, contends he has discovered the "smoking gun" that until now was obscured for decades by the Saudi's limited disclosure. Our review offers some balance to the dire predictions of *Twilight*.

An Independent Reservoir Engineering Persective of *Twilight*

As petroleum engineers, we do not support the key conclusions and speculative theories contained in *Twilight*, and notice numerous technical gaffes.[1] We think there is a lack of clear context and consideration of market dynamics around the key issues identified in *Twilight*.

In general, the SPE papers referenced in *Twilight* comment on the unremarkable operations that oil and gas companies carry out all over the world on maturing producing properties. In Saudi Aramco's case, these operations are carried out on truly remarkable reservoirs.

We believe *Twilight* attempts to turn benign technical matters into crisis-level evidence. It could be that what is regarded as normal is based on the author's exposure to North American reservoirs operated by public companies. These companies do not produce to quotas, but instead deplete reservoirs as fast as commercially possible and rarely allow reservoirs to produce at peak rates for more than five years. By comparison, Saudi Aramco has carried excess capacity in its key reservoirs for more than 50 years.

The author appears to have been set off by a Saudi Aramco official who explained that the company's reserve determinations are aided by the use of "fuzzy logic." Apparently concluding that fuzzy logic means fuzzy numbers, *Twilight* suggests there is reason to be concerned about Saudi reserve assignment methodology.

Fuzzy logic is actually a probabilistic method for gaining insight on large data populations developed at the University of California – Berkeley in the 1960s. It models probabilistic relationships between variables and is often called stochastic modeling. In the case of reservoir engineering, for example, "If permeability is low and natural fractures are vertical, then there is a high probability that water breakthrough could occur at various (but early) times." Fuzzy logic is a valuable analytical tool and has proved to be very useful in expert systems, artificial intelligence and other applications for reservoir scientists and engineers. Whether it is conservative or not depends on the probability relationships of the input parameters, the definition of which improves the more history there is.

We focus in this report on three key issues:

1) Are Saudi oil reserves grossly overstated?
2) Can Saudi production rates collapse?
3) Are the Saudis exploring enough or not enough?

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Are Saudi Oil Reserves Grossly Overstated?

In Chapter 12, "Saudi Oil Reserves Claims in Doubt," *Twilight* disputes the veracity of Saudi Aramco's estimated 260 billion barrels in remaining conventional proved oil reserves.

Reserve Assignment Methodology

The assignment of reserves is rooted in engineering judgment and a formal opinion about Saudi reserve levels would require a detailed look at all reservoir information. When that is not available, a review of reserve booking methodology or practice is a legitimate way to gauge diligence, reservoir understanding and ultimately reasonableness. The methodology adopted by the Saudis to book reserves, as described in their February 24, 2004 presentation to the U.S. Center for Strategic and International Studies (CSIS), is in our opinion as conservative as that used by any publicly traded E&P company following SEC reserve assignment guidelines.

Twilight is suspicious about Saudi Aramco's practice of assigning reserves based on probabilities. We think this approach is not unique to the Saudis or any more uncertain than the way every publicly traded North American E&P company books reserves under closely regulated SEC guidelines. Have the Saudis overbooked their reserves? Let's look at what we know.

In the CSIS presentation, Saudi Aramco's manager of reservoir management, Dr. Nansen G. Saleri, described the company's reserve assignment methodology in some detail. Saudi Aramco follows a "Constitution" that prescribes principles of management, production and depletion for their reservoirs.

The first principle is to maximize recovery. The second is the requirement for reservoir surveillance and monitoring; third is the maintenance of low depletion or decline rates. As a fourth principle, Aramco relies on advanced diagnostics that use quantitative methods such as reservoir simulation – a lost art in North America – to characterize reservoirs in extreme detail. Advanced seismic also allows better well placement. At Ross Smith Energy Group (RSEG), we use reservoir simulation when evaluating properties because it is an efficient way to compile data and can provide an accurate characterization and production forecasts.

Saudi Aramco's fifth governing principle is to consider cutting edge technologies and use them when appropriate.

Reserves Categorization

Of the 260 billion barrels of proved reserves, 50% are proved developed – a classification that *Twilight* neglects to cite. By SEC standards, developed reserves have been drilled, tested and tied in. They produce at commercial rates and can be forecast, or require little capital to do so. Proved developed reserves should receive the highest valuation of any class of reserves because they are cash generating assets. The ambition of every E&P operations department is to convert as much of the reserve base to proved developed reserves as possible.

What do we know about the Saudi's criteria for categorizing developed reserves?

When Saudi Aramco takes a reservoir off line for market reasons – such as the giant Manifa and Khurais fields, with combined proved reserves of 41 billion barrels – the associated reserves are reclassified as undeveloped, despite the fact they are tied in and no additional capital is required to turn them back on. We have never seen a North American energy company reclassify reserves in this manner. Furthermore, in classifying proved reserves, Saudi Aramco excludes enhanced recovery upside, even when performance dictates otherwise. This is in contrast to SEC guidelines, which allow for such assignments. Aramco's practice probably results in annual positive revisions to proved developed reserves because the fields likely deliver better than forecast performance.

Subcommittee on Foreign Affairs Report of 1979

In Appendix C, *Twilight* attaches importance to the 1974 Senate subcommittee hearings and an April 1979 report titled *The Future of Saudi Arabian Oil Production: A Staff Report to the*

Subcommittee on Foreign Relations, United States Senate. The author of *Twilight* writes: "These records contain the smoking guns to back up the findings of my SPE paper research and confirm that they are neither misleading nor overblown." The 1979 report is described as having identified a growing series of problems that were documented in the SPE papers. *Twilight* recounts how the staff report predicted that irreversible decline would commence in north Ghawar between 1989 and 1992, should the reservoirs continue to produce at 4.4 million barrels per day.

This decline didn't happen.

We believe the 1979 report was published in the wake of Ghawar's first serious water breakthrough and pressure decline. The prediction of imminent oil production decline probably resulted from the report's authors assuming the water breakthrough was unmanageable and would continue, a reasonable assumption at the time.

As we know now, not only was Ghawar's water cut increase arrested when it peaked at 37% in 1999, it was reversed thereafter. The predictions made in the 1979 Staff Report did not have the benefit of decades more of data gathering, reservoir characterization or an appreciation of the benefits available from new technologies such as horizontal and multilateral drilling. While provocative then, the concerns of the 1979 report have been proven wrong and are irrelevant now.

How can you Control an Increasing Water Cut in a Mature Waterflood?

The manner in which a water cut will behave after breakthrough at a well depends on the "fractional flow relationship" between the oil-water-rock system. Generally speaking, the higher the viscosity of the oil, or the thinner the reservoir, or the harder you pull a well, the more abrupt and serious water breakthrough can be. In the key Saudi fields that operate under peripheral water injection there is light oil and very thick reservoirs, both of which would contribute to a more gradual water cut increase after breakthrough. How hard you produce a well is a decision that comes from the operator.

Twilight reports that because the water cut has increased, Saudi Aramco is pulling harder on the wells in Ghawar, to produce more oil and that the 1979 Staff Report supports this conclusion. Pulling harder means increasing the pressure drawdown in a well. The greater the drawdown, the higher the likelihood of pulling up, or coning water into the well. *Twilight* muses, "It seems fair to ask whether these key fields are now being produced, or rather overproduced, at unsustainably high rates that will accelerate reservoir pressure decline." In fact, the opposite is true – Saudi Arabia's current wells actually are being pulled 'softer' not harder.

Reservoir engineers recognize a well's "productivity index" as a measure of its production capability. The units of the index are barrels per day per psi of pressure drop. The harder you produce a well (larger the pressure drop), the more production you get. A prolific vertical well might have a productivity index of 15 bpd/psi, meaning for a 100 psi pressure drop, the well produces 1,500 bpd. And in this vertical well, the pressure drop is concentrated around its vertical penetration of the producing formation.

We understand that for more than a decade, essentially all drilling at Ghawar has been conducted with horizontal wells and, more recently, multilateral horizontals. A multilateral well may have half a dozen horizontal laterals that spread out over several square miles of reservoir. The productivity index of these wells can be 10 times or more that of a vertical well, meaning half the pressure drop can produce five times the production rate. Furthermore, the drawdown of a multilateral well is distributed over a large area, meaning water coning potential is greatly diminished compared to that of a vertical well.

This is how oil production rates can be held flat, while lowering the water cut. The impact of multilateral wells on water production control is explained in a series of SPE papers. One such paper, SPE 84923, was authored by Dr. Saleri, two months before his CSIS presentation. It was referenced in *Twilight* only to point out that the uncertainties discussed therein contradict the assertions of Dr. Saleri's CSIS presentation, ignoring the technology's demonstrated benefits.

How do these Operations Affect Oil Production Declines?

The resulting modest pressure drawdowns from multilateral wells also enable reservoirs to be produced at extremely low decline rates. Why is that? If you are maintaining reservoir pressure and the cause of production decline is water encroachment, then as water is drawn into the well more gradually, the decline will be correspondingly more gradual. Accordingly, the decline in capability is slower. The production-weighted average decline in Saudi reservoirs over the recent past is about two percent per year according to Dr. Saleri. In other words, only 200,000 bopd need to be added to maintain 10 million barrels per day production.

Resource Play Methodology?

Another advantage of producing slowly is for advances in diagnostics and improvements in technology to catch up. Saudi Aramco's SPE paper trail represents to us an unprecedented effort to characterize and address reservoir performance using state of the art methodologies.

For example, had the authors of the 1979 Staff Report evaluated any of EnCana's current properties such as the Piceance Basin, or any Canadian oilsands operation, they would have struggled at the time to see any producible reserves given the prevailing technologies of the time.

Examples of Challenges with Key SPE Research

In Chapter 12, "Saudi Arabian Reserves Claims in Doubt," the lynchpin of *Twilight*'s discussion on Saudi reserves, we find only one SPE paper referenced. This paper, SPE 68603, does not address the subject of Saudi Arabia oil and gas directly. It describes a benign concept about the value of information, indicating that risk reduction may be achieved by drilling wells. We couldn't agree more.

In Chapter 13, "Facing the Inevitable," *Twilight* says: "Assuming that the Saudi sponsored papers present an accurate description of the problems affecting the Kingdom's oilfields (and further assuming that I [the author] have performed a reasonable, unbiased review and analysis of these papers and properly connected the dots), it would seem safe to conclude that Saudi Arabia's oil output is unlikely to grow in coming years and soon could decline."

Twilight dedicates two-plus pages in Chapter 13 on SPE paper 84459, *Quantification of uncertainty in recovery efficiency predictions: Lessons learned from 250 mature carbonate fields*. We believe *Twilight*'s key conclusions are incorrect:

1. *Twilight* says: "…the average ultimate recovery for carbonate reservoirs with medium to light gravity oil is about 35% of OOIP. "

   What SPE 84459 actually says is, "Overall, the carbonate oil reservoirs have an average ultimate recovery factor of 36%…" That includes lower recoveries from heavy (<22 degree API) reservoirs. Contrary to *Twilight*'s conclusion, recovery in the light and medium crude reservoirs therefore must be higher.

2. *Twilight* also claims that SPE 84459 indicates ".. some of the worst recovery efficiencies in reservoirs with a strong water drive resulted from poor or improper management during the field's natural water-driven production phase." It reports that the SPE authors say "the best way to avoid such problems is to control the production rate carefully by reducing the choke size as soon as water cut reaches even two percent." The report discusses how management (at the time, Repsol, the Spanish state company) of the Casablanca field, a Type II fractured/karstic carbonate reservoir in Spain's offshore, carefully controlled the water cut by reducing choke size. *Twilight* observes that "these prudent practices were obviously not followed in Saudi Arabia's giant oilfields," implying poor and inappropriate reservoir management by Saudi Aramco.

The SPE report actually explains that "A few Type II fractured/Karstic oil reservoirs with strong water drive did not deliver optimal recoveries because of poor management of water production."

However, the Arab D reservoir is not a Type II fractured/Karstic reservoir. Many of the SPE papers *Twilight* references document it as a grainstone, a cleanly washed, well sorted carbonate sand that has been dolomitized and sometimes naturally fractured. SPE 84459 classifies these grainstones as "conventional carbonate reservoirs."

According to SPE 84459, grainstone reservoirs enjoy the highest recovery factors of any carbonate. The report notes ExxonMobil's Jay Field in north Florida as having the highest observed ultimate recovery (68%) among grainstone reservoirs. The Smackover formation in the Jay Field has an average porosity of 15% and permeability that reaches 100 md. According to SPE paper 85, also cited by *Twilight*, the Arab D zone in Abqaiq, for example, has an average porosity and permeability of 21% and 410 md, respectively, vastly superior reservoir quality than the Jay Field, and all else remaining equal, should result in a higher ultimate recovery factor.

Therefore, our reading of SPE 84459 predicts a recovery factor for Arab D significantly in excess of the Jay Field – opposite to *Twilight*'s conclusion.

In summary, we have a much more benign view of Saudi Aramco's reserve booking practices than indicated in *Twilight*:

- In our opinion, Saudi technical reserve assignment methodologies are at least as conservative as SEC standards.
- Except for EOG Resources and EnCana, we have seen no one with a comparable reservoir management "constitution" to Saudi Aramco's.
- Management of their reservoirs according to this constitution has enabled an extremely flat ~2% annual decline.
- Producing their reserves over a long time period has allowed Saudi Aramco to accurately characterize the reservoirs and to choose and fine tune appropriate new technologies, in much the same way that EnCana benefits from their "resource plays."
- By not booking reserves that may be derived from enhanced recovery as the SEC allows, better than expected performance probably results in periodic positive reserve revisions.

Can Saudi Production Rates Collapse?

On Lou Dobbs' CNN show on August 23, 2005, Mr. Simmons, the author of *Twilight*, said: "The real issue is only a handful of fields have produced all the oil Saudi Arabia has ever produced. And they're all old. And they're all at risk of production collapse."

We believe the data show no evidence of collapse.

What would make a reservoir performance collapse?

We have earlier discussed how the implementation of multilateral wells can replace a locally concentrated pressure drawdown associated with vertical wells, with a lower overall pressure drawdown spread over several square miles. This increases the time that the oil-water contact, which is rising due to water injection and oil production, is "gravity stable" or flat. The longer that Saudi Aramco can keep the oil water contacts flat, the more that recovery is maximized.

Pioneer's deep GOM Harrier field, for example, collapsed because it was a one vertical well pool over water that was produced too hard. Chevron's Northwest Territories, Fort Liard play collapsed for much the same reason. In the Deep Gulf, Anadarko's Marco Polo and Nexen's Aspen also experienced premature water breakthrough shortly after start up due to production rates from key wells that in retrospect were too high. Unexpected behavior typically occurs because of reservoir depletion strategies underpinned by an inadequate understanding of the reservoir. Reservoir understanding was not adequate partly because these reservoirs were new, an issue that the Saudi reservoirs do not have.

At RSEG, we evaluate and characterize the risk of unpredictable production failure for each E&P company we cover. Having a diversified production base and being less dependent on a few wells means some wells can fail without a material impact or collapse of total production.

Among Saudi Aramco's key assets, there are hundreds of wells with unprecedented, well-documented operating histories. The gathered production data provides evidence of rate sensitivities in each region of each mature field. Note that each of the reservoir failures referenced above involved early stage production before such characterization or rate sensitivity was possible. Further, forecasting becomes more reliable as more history is gathered, trends are established and reservoir behavior is understood. Among the other factors we consider are:

- Does the operator have the expertise to operate their projects?
- Does the operator have an adequate monitoring system?
- Are the recovery schemes new or is there a long history enabling reliable forecasting?
- Is there a well established production decline and water cut trend?
- Is the water cut under control?

We are satisfied that all these check out with respect to the reservoirs Saudi Aramco has reported on.

On pages 117-118, *Twilight* states, "The remarkable Arab D Zone 2-B is responsible for at least 70% of Saudi Arabia's current oil output." If this were true, it would be the opposite of diversification and we would be very nervous. However, on page 91, *Twilight* reproduces a statement from a 2003/2004 Saudi Aramco brochure indicating "The horizontal wells being drilled into the super-giant Ghawar are penetrating into thin, unproduced pockets of oil in areas like the Post D stringers, low permeability zones scattered amid Zone 2-B's now drained but once high permeability reservoirs…"

In our view, these statements are contradictory; either the zone is responsible for 70% of current output or it is drained. If Zone 2-B is now drained, there is far more asset diversification and significantly lower "collapse risk" than asserted by *Twilight*.

Twilight observes that the average water cut of current Saudi wells is around 35%, which agrees with SPE research and Dr. Saleri's CSIS presentation material. Since pressure maintenance through water injection is the predominant recovery mechanism in Saudi reservoirs, unpredictable and massive water breakthrough would be the cause of any reservoir-controlled oil production collapse. SPE 89764 reports that more than 8,000 wells have been logged in the Kingdom. So, if wells begin to show increases in water cut, the increase will be gradual and as the Saudis have shown, manageable. It would be unusual (to put it mildly) for all producers to suffer a catastrophic and unpredictable water breakthrough at exactly the same time. Conclusion: we think none of the Saudi reservoirs are on the brink of collapse; on the contrary, they appear to enjoy a gradual and well-managed depletion.

In summary:

- Saudi production comes from a very diverse base of thousands of wells.
- The aggregate water cut is low, recently around 35%.
- The wells have optimum completion designs, which minimize pressure drawdown, maximize recovery and reduce the risk of catastrophic water production.

Are the Saudis Exploring Enough or Not Enough?

Besides the notion that "all" Saudi fields are on the verge of collapse, the *Twilight* scenario relies on the premise that remaining prospectivity for producible oil in Saudi Arabia is limited, despite Aramco's "intense search" for it.

In fact, only 69 exploration wells have been drilled in Saudi Arabia in the past 10 years. With up to 5 million bopd in excess producing capacity on their books over much of this period, 260 billion barrels of proved reserves in the kitty, and low decline rates, why would the Saudis want to look more strenuously for more reserves? Why would they pour money into drilling new discoveries, when only 23 developed reservoirs out of 80 defined discoveries have provided them with adequate

production capacity to meet market needs for more than 50 years? And even if, for argument's sake, Saudi proved reserves are only half Aramco's estimate, replacement at the current production rate would only be 2.6% - hardly a challenge.

On the topic of remaining reserve potential, *Twilight* ignores a prominent, and in this case unbiased, independent opinion. In 2000, the US Geological Survey (USGS) ranked Saudi Arabia number one in the world, in terms of undiscovered resource potential, with a mean expectation of 87 billion barrels of oil and a range between 29 and 160 billion. The USGS figure also is conservative, dating from a time when the outlook for real long-term oil prices was much less bullish than it is now. Price expectations then were absolutely miniscule compared to *Twilight*'s current forecast of $200 per barrel oil by 2010.[2]

Concluding Remarks

We were guided by the February 2004 presentation to CSIS by Dr. Nansen G. Saleri titled *Fifty Year Crude Oil Supply Scenarios: Saudi Aramco's Perspective*. The presentation included depletion levels, decline rates, water cuts, a discussion and comparison of reserve assignment methodology, historical drilling success rates, production forecasts and supporting documentation and details of the USGS report on the undiscovered potential of the Kingdom. This is one of the most in-depth presentations we have seen.[3]

Twilight only mentions the presentation, ignoring much of its contents and chooses instead to use the presentation to claim that it is in contradiction to Dr. Saleri's SPE Distinguished Author publication. *Twilight* cites the paper delivered by Dr. Saleri in December 2003 (SPE 84923) and claims that the CSIS presentation "differed sharply from the Distinguished Authors paper he helped write a few months earlier." The offending passage quoted by *Twilight* was that a more complete evaluation of MRC drilling would require "three to five years of continuous production history." According to *Twilight*, Dr. Saleri's February 2004 presentation rejected these uncertainties. Again, we feel this is where a little context would have been helpful. In what respect is there uncertainty? Cost? Performance? Drilling time? Operations? We believe there is not enough information here to dismiss the Saudi forecast let alone an entire comprehensive presentation.

During a Q&A after his presentation, Dr. Saleri warned against focusing on the SPE papers as they tend to focus on technical challenges and the engineering applied to address them. Accordingly they paint a somewhat negative picture on balance. The SPE mission is "to collect, disseminate, and exchange technical knowledge concerning the exploration, development and production of oil and gas resources, and related technologies." Accordingly, reporting on the implementation of new technologies and transferring that information among members is critical.

It appears that *Twilight* chooses to believe that the bits and pieces of operational history these papers represent, can offer an accurate view of the Saudis' oil production future. We struggle with how *Twilight* could dismiss the guts of a presentation made by the Saudis in a forum like CSIS - in front of hundreds of very savvy energy lawmakers and investors. We make no such distinction within the continuum of Saudi insight spanning about 50 years, up to and including Dr. Saleri's CSIS presentation.

Who is Dr. Saleri? According to his biodata on the Saudi Arabian Section of the SPE website, he holds M.Sc. and Ph.D. degrees in chemical engineering from the University of Virginia. He worked for Chevron for 18 years, up to 1992, most recently as Manager of Reservoir Engineering Services. He is a member of the Advisory Board of Petroleum Engineering at the University of Houston. He is an SPE Distinguished Lecturer. Without having met him, these credentials would suggest a very solid, industry tested petroleum engineer who has earned credibility from peers.

Why would Saudi Aramco lie about what's going on? As we have seen elsewhere, reservoirs are merciless in getting the truth out, as seen by the recent experiences of Pioneer, Marathon, El Paso or Shell. Furthermore, there is no substitute for doing homework on a field, gathering the data and managing the assets like they are precious.

Overall, we think, Saudi Aramco has given us no reason to doubt statements about its reserves or future production capacity.

Endnotes

[1]For example, Twilight implies the 'dew point' is the pressure at which a well stops flowing or producing. In fact, dew point is a thermodynamic state of pressure and temperature such that for a gas at a given temperature, lowering the pressure below the dew point will cause natural gas liquids to condense from the gas. As another example, Twilight indicates that reservoir pressure will "fade away" as a water flood matures. Rather, a key purpose of a water flood is pressure maintenance. The abandonment pressure typically is the water flood operating pressure. Furthermore, water injection does not erase the possibility of having secondary recovery, as Twilight states. It is secondary recovery. In another example, SPE 71339 focuses on attempts to understand the tilted oil-water contact found in the Haradh structure in the south of Ghawar. Following a recommendation of Exxon, a reservoir model was constructed. Saudi Aramco engineers were then able to mathematically recreate the tilted oil-water contact by simulating the injection of 5,000 barrels of water per day over a period of 20,000 years along Haradh's west edge. Twilight concludes that "At that rate it would only take 20,000 years to push the oil water contact to the top of Ghawar's southern end." In our view, this statement misses the point. The paper is simply a description of a successful modeling exercise designed to interpret one of a myriad of reservoir characteristics in a big field. Another example comes from an observation that original oil in place (OOIP) estimates can miss the mark by 60 to 80%. In fact they can be out by thousands of percent: imagine the OOIP estimate after the first well in Ghawar. However, as fields are drilled up, estimates are tightened and ultimately, in high quality reservoirs, OOIP actually becomes one of the more reliable reservoir estimates.

[2]The New York Times, 23 August 2005.

[3]Dr. Saleri's CSIS presentation and speaking notes can be accessed at http://www.saudi-us-relations.org/energy/saudi-energy-reserves.html.

A Market In Levitation: How Long Can It Last?

*by Nordine Ait-Laoussine**

Introduction

I use the term "levitation" in the title to mean that current oil prices are above the equilibrium justified by normal supply and demand considerations or what we generally refer to as market fundamentals. Perhaps I can best explain the use of the term "levitation" by drawing an analogy with hot air balloons, which do not alter or disprove the laws of gravity. To remain aloft, they require a source of heat on board which, in turn, requires fuel. Provided with sufficient fuel, hot air balloons can remain in the air for significant periods and, in exceptional cases, long enough to go around the planet. But, eventually, they all succumb to gravity and return to earth.

Similarly, current oil prices do not imply a change in the laws of economics. Prices can be lifted temporarily far above what is required to ensure an adequate level of capacity all along the supply chain, provided sufficient heat is applied (in the form of fear of supply disruptions, market anxiety, peak oil phenomenon, speculation, geopolitical tensions, hurricanes or what have you). But the market will remain in such a state of levitation, just like a hot air balloon does, so long as the supply of "heat" continues. How long will the current sources of "heat" last? This is the crucial question that underlies the title of this presentation.

Recent Market Developments

The last time Brent traded at $ 20/B was in January 2002. It has traded at consistently higher levels since then, broke, in May 2004, its nominal record of $ 39/B established during the Gulf war, crossed several milestones since and, although it has recently retreated a bit from the $ 70/B mark, many are betting that it may go even higher by year end. The scale and persistence of this dramatic price rally has confounded all analysts in spite of the fact that they broadly agree on the drivers which have combined to destabilize the supply-demand equation. These factors include:

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- First, an industry capacity strained to the limit, both upstream and downstream, resulting from:

    1. The unanticipated surge in oil demand, particularly in Asia, including the sudden jump in Chinese oil consumption which was unforeseen by virtually every analyst;

    2. The realization that non-OPEC supply growth is flattening and that it will, at best, provide a declining share of the anticipated increase in demand requirements;

    3. The correlative improvement in the call on OPEC crude oil which raised member countries' output virtually to sustainable capacity; and

    4. A refining industry which was unprepared for the surge in demand, particularly for the growing gravity gap between a lighter demand barrel and a heavier supply barrel.

- Second, the tightness in the production and refining capacity created an unprecedented level of market anxiety fuelled by:

    1. Persistent fears of supply disruptions, resulting from actual and potential accidents, social unrest and geopolitical tensions affecting the major producers; and

    2. The "peak oil" phenomenon, fed by real or perceived signs of approaching resource exhaustion.

- Third, the market anxiety has been aggravated by a growing lack of confidence in the industry's ability to remove the bottlenecks along the supply chain with:

    1. Misgivings about the international oil companies' abilities to achieve their growth targets and reserve replacement objectives; and

    2. Apprehensions about OPEC's ability – or even, perhaps, willingness – to achieve a timely and adequate capacity expansion.

As I am sure you know, the perception of market tightness and the associated fear of supply disruptions have been with us for quite some time now. Signs of refining "bottlenecks" appeared, in fact, as early as the summer of 2000 when crude oil prices surged in spite of ample crude supplies. The production capacity concerns started to appear in 2003 with the interruption of Venezuelan exports, the Iraq war, terrorist attacks in Saudi Arabia, surfacing doubts about the Kingdom's real production potential and a whole list of other events.

The "shortage" mentality was reinforced in 2004 with Shell's substantial reserve downgrade, concerns about Venezuela's output recovery, continued social unrest in Nigeria and Venezuela, repeated attacks on Iraq oil infrastructure, the Yukos saga in Russia and, last but not least, the growing realization that OPEC output was approaching its capacity limit at a time when reports of exceptional demand growth were constantly revised upward, especially in China.

More recently, we had the same series of events threatening supply disruptions in Iraq, Nigeria and Norway, threats of terrorist attacks in Saudi Arabia, increasing tensions in Iran over the nuclear issue, refinery shutdowns in the US and a widespread concern over continued market tightness during the approaching winter season.

If you add to this weather related accidents, such as Hurricanes Ivan last year and Katrina recently, we did go through, over the last couple of years, the same pattern of endless potential or real supply disruptions. Yet, prices have increased, so far this year, at approximately twice the rate recorded last year. Admittedly, it is difficult to measure the intensity or the precise impact on the market of each event but it is difficult to rationalize the dramatic acceleration of the price increase this year, especially in light of the appearance, as we shall see later, of some calming effects

resulting from signs of lower demand growth, rising OPEC production and higher crude inventories. In my view, this acceleration can be attributed to a profound change in the respective influence of OPEC and the futures market on the process of price formation. Let me discuss these issues first before I consider where we are heading to.

The Eclipse of OPEC's Market Power

To begin, first, with OPEC, nobody would disagree with the fact that it has not always been successful in its repeated attempts to influence the market in the intended direction and that, over the last 20 years or so, its supply management practice did not enable the Organization to achieve its price objective, except for a year or two.

But, with the emasculation of its supply management tool, resulting from the loss of member countries' production cushion since the middle of last year, OPEC has now become totally powerless as demonstrated by its recent fruitless efforts to calm the market. For all practical purposes, the quota system has become irrelevant. Moreover, the Organization's price objective has become obsolete and was suspended early this year. I understand that a new objective will be discussed next week in Vienna but it is highly doubtful, in my view, that a new target will be established under the prevailing market conditions. It serves no purpose, indeed, to set a new OPEC benchmark when the Organization itself admits that it can do little to influence price direction.

In short, after having exhausted all possible means to calm the market frenzy, OPEC appears to be adopting a "laissez-faire" attitude. Member countries continue to meet demand requirements up to their capacity limits. They are letting the market rule and enjoying the benefit of hefty prices as long as they last. After all, why should they refrain from taking advantage of the so-called market mechanism which has often worked against their interests in the past?

The Overriding Influence of the Futures Market

Turning now to the influence of the futures market on the process of price formation, I have often said in this room that the benchmarks we use in gauging the state of the market, such as Brent or WTI, do not always reflect a change in the physical market fundamentals. As a result of the vacuum created by the eclipse of OPEC's power, the market is now increasingly dominated by pure financial players mostly involved in non-commercial trade and moved by their perception of future price trends in which the interaction between supply and demand play a minor and diminishing role.

When the Saudi oil minister, Ali Naimi, admitted, in a conference in Paris early this year, that the Kingdom and OPEC had little ability to curb the rapid rise in prices, he had this to say about the growing influence of the futures market "The futures market has a major influence over the physical prices. Twenty-five years ago, we did not have a futures market for oil, and when it started in the early eighties, there were a handful of players with investments of no more than $5bn. Today, there are thousands of players in energy futures markets with annual transactions amounting to trillions of dollars. These players include oil companies, producing and consuming governments, hedge funds, institutional investors, traders, and speculators…"

The Saudi Oil Minister also said on the same occasion: "Oil indeed has become a financial investment asset. It is attracting vast sums of money from hedge funds and institutional investors seeking to maximize returns and diversify their portfolio. There is a widespread feeling in the industry that this activity will continue to push the market higher despite OPEC and Saudi Arabia's strong efforts to stabilize the prices… Recent information indicates that even banks are jumping on the bandwagon. Some analysts expect that oil could soon be traded as an exchange traded fund, meaning that it could be offered almost like a stock. Since this activity would be open to the general public, it could attract even more investors…"

It must have been very frustrating for the world's biggest oil producer and exporter to realize that the Kingdom can no longer influence – if not dictate – the price of this vital commodity!

The most important lesson that we learned from the exceptional market conditions experienced over the last couple of years, in particular since the beginning of this year, is that oil prices have taken their direction primarily from non-fundamental factors which frequently overwhelmed market fundamentals. Clearly, it is difficult to rationalize the continuing market nervousness on the basis of simple oil supply, demand and stock levels. Extraneous factors, such

as geopolitical uncertainties, exaggerated anxieties over resource exhaustion and speculative moves play, today, a preponderant role in determining day-to-day oil price swings. Speculators, in particular, seize every traumatic news headline to reinforce their collective belief that prices will be driven even higher. The recent excessive popularization of the "peak oil" theories is an example of how the undeniable fact that oil is a depletable resource can be exaggerated to produce a sort of self - fulfilling prophecy, i.e. "oil prices soar because everyone believes that oil prices will soar". The result is price levitation. So, back to the question: How long can it last?

The Emerging "High Prices are Here to Stay" Consensus

At the last Oxford Energy Seminar a year or so ago, Brent was already trading in a $ 40-45/B range but opinion was still divided on whether the dramatic upturn, experienced in the market since the 1998 price collapse, was the result of temporary distortions in the supply-demand balance or of more fundamental factors affecting the global industry. Today, the prevailing view is that the market is in the midst of a major and possibly lasting structural change implying that the current high price environment is here to stay. A consensus is, indeed, emerging that oil markets have entered "a new paradigm" in which higher oil prices have become a permanent feature. The rationale supporting this new perception is summarized by five propositions:

- One: The world has moved to a permanently higher oil demand growth generally projected at a rate in excess of 2% pa. It is argued that developing countries, led by China and India, have suddenly become large consumers and importers, which is true. Upward leaps of apparent Chinese consumption are extrapolated to other developing countries, suggesting the emergence of a worldwide scramble for oil supplies. This perception is enhanced by the decision of Chinese and other oil importing countries to enter the competition for upstream opportunities.

- Two: Non-OPEC supply will only meet a declining share of the anticipated demand growth. It is generally assumed that it will reach its peak by 2015 but some analysts argue it may happen even sooner. Moreover, it is argued that IOCs will move only cautiously to increase upstream investment because they are unlikely to change their conservative hurdle price assumptions.

- Three: The exceptional global demand spurt in recent years drove OPEC to production levels closer to capacity, which is true. But it is argued that, while OPEC countries have a sufficient resource base to meet long-term demand, they will "drag their feet" in expanding capacity for fear of a price collapse.

- Four: Refining capacity was unprepared for the surge in demand due, in part, to low levels of investment in this normally low profit sector of the industry, but also to environmental restrictions on new grassroots refinery projects in some countries. It is argued that it will take years for refinery "bottlenecks" to recede.

- Five: It is argued that higher oil prices are sustainable because they have not thrown the world into recession. It is pointed out that economies are displaying remarkable resilience and that earlier warnings that sustained oil prices over $ 30/B would cripple the world economy have been proven incorrect.

An Alternative Vision of the Future

To be fair, I must indicate that, in view of the dramatic acceleration of the price increase experienced recently, the high price level referred to, at various times, by the proponents of the emerging consensus is not clear. But whether it is $50, 60 or 70/B, I do not believe that, at these levels, the market will remain tight forever. Let me explain why and highlight some of the incoherencies I perceive in the rationale which supports this consensus:

- First, market tightness will recede because demand growth will moderate:

    1. OECD demand growth is slowing, with Europe stagnating, US easing (partly as a result of Hurricane Katrina) and lower growth appearing elsewhere;

    2. China's oil demand growth is returning to levels more in line with the country's GDP. It is widely conceded now that last year's spurt of apparent Chinese

consumption was an aberration;

3. Developing countries are curbing demand growth by reducing subsidies, introducing fuel taxes, imposing import restrictions and considering mandatory conservation measures;
4. Global oil demand in 2005 and 2006 is generally expected to grow at half of the exceptional rate of 3%+ recorded in 2004; and

5. The longer prices remain at present levels, the greater will be the deceleration in demand growth due to conservation and substitution measures which, as you may have noticed, are back on top of the agenda of consumer governments.

All in all, if you believe that "high prices are here to stay", then you cannot also believe that oil demand will continue to grow at the rate experienced during the last couple of years. That's the first incoherence.

- Second, the market tightness will recede because the emerging supply response to higher oil prices will become more evident in non-OPEC countries:

  1. Oil industry upstream investment is increasing worldwide;

  2. Several significant non-OPEC field developments are scheduled to come on-stream during the next few years in various parts of the world, including Russia, the Caspian Sea, Brazil, Angola and other African countries which will more than offset the continuing North Sea decline;

  3. Barring another devastating hurricane for a third year in a row, non-OPEC supply growth is expected to rebound next year to around 1mn b/d and to remain positive for several years, albeit at gradually declining rates; and

  4. Production of non-conventional oil is set to expand substantially in Canada, the US, Venezuela and Madagascar.

If you believe that "high prices are here to stay", then why would you doubt that IOCs will further increase their hurdle price assumptions to test the economic feasibility of new, inevitably more expansive projects, both in conventional and non-conventional oil developments? That's the second incoherence.

- Third, the market tightness will recede because OPEC capacity expansion plans are moving forward:

  1. All OPEC countries are implementing large capacity expansion plans. It is in their commercial and strategic interest to do so;

  2. Excluding Iraq, OPEC-10 sustainable capacity, now in excess of 30mn b/d, is expected to increase by 5mn b/d by 2010;

  3. Any increase in Iraq, if the political situation should stabilize, would be above the projected capacity increase; and

  4. While the new wave of resource nationalism can reinforce "go-it-alone" attitudes, most member countries are actively seeking partnerships and alliances with IOCs and consumer country NOCs.

If you believe that "high prices are here to stay", why would OPEC countries restrict capacity expansion for fear of a major price downturn? That's the third incoherence.

- Fourth, the market tightness will recede because refining "bottlenecks" will eventually

dissipate:

1. Several new grass-roots refineries are being planned in the Middle East and Asia with a combined capacity of about 5mn b/d;

2. Expansion of existing refineries is now encouraged throughout the OECD countries; and

3. Synthetic crude "upgraders", increasing condensate output and announced GTL projects, will reduce the pressure of the growing gravity gap.

Again, if you believe that "high prices are here to stay" and that the refining industry is entering a new "golden age", then why would you doubt that refining capacity tightness will dissipate in the medium term? That's the fourth incoherence.

- Fifth, the relentless price increase has heightened the concern about the potential of a worldwide recession:

The apparent economic impact of higher oil prices has, so far, been relatively muted compared to previous price shocks: inflationary pressures have been contained and economic growth globally sustained. There are several reasons for this unexpected benign or delayed impact:

- Oil prices have been lower in real terms than their early 1980s peak;
- The price rally has been gradual;
- Industrialized countries have insulated themselves from high energy prices by reducing energy intensity;
- Interest rates have remained at a relatively low rate for several years; and
- Higher excise taxes on petroleum products have dampened the effect on consumers' prices.

But signs are appearing that current prices are starting to adversely impact the world economy:

- Real oil prices are now approaching levels last seen in the early 1980s;
- The price increase this time was, indeed, more gradual but it is not over yet;
- Inflation is rising, though at a measured pace;
- Expectations of economic growth are being revised downward by 1-2% of GDP, almost everywhere except in oil exporting countries; and
- The US expansionist fiscal policy, which has provided a stimulus for the world at large through its budget and trade deficits, cannot continue indefinitely.

Contrary to the emerging conventional wisdom, the implication of the "high prices are here to stay" perception is a more likely economic recession as the expectation of permanently higher prices could rapidly change consumers' behavior. This could also be considered as another incoherence in the thinking of those analysts who did not put a limit to how far oil prices can go before they start damaging the world economy. Let's not forget that, virtually every recession in the past four decades, have been preceded – if not caused – by a sustained increase in oil prices.

Geopolitics: The Great Unknown

This being said, market anxiety will not disappear overnight and will persist as long as the ongoing geopolitical tensions are not eased:

- As I said, signs are appearing that higher prices are beginning to impact the global economy, moderate oil demand growth and stimulate a rebound of oil industry investment worldwide, both upstream and downstream.
- The physical market tightness should, therefore, gradually recede but market anxiety over potential supply disruptions will persist for a while under the current geopolitical environment.
- The process of adjustment to a lower more sustainable price level will take some time

depending on both short-term price developments and the evolution of the ongoing geopolitical tensions (affecting the major producing countries) which, among all the forces affecting the oil market, is the most difficult to predict.

To return for a moment to market levitation and my analogy with hot air balloons, the primary source of "heat" is anxiety and, like it or not, the principal source of anxiety today is Middle East turmoil enhanced by the chaos in Iraq. As the occupation of Iraq drags on and internal strife accelerates, with no realistic US exit strategy, the world's perception that the conflict risks destabilizing the entire region has been reinforced.

To be sure, other sources of "heat" contribute to the levitation of oil prices such as hurricanes in the Caribbean, threats of oil workers' strikes in Nigeria and Norway, political unrest in Ecuador, and refinery accidents in North America. These and similar events have been common in the industry for decades. But, were it not for the underlying anxiety about Middle East instability, these other sources of "heat" would not be sufficient to sustain the oil price balloon for such an extended period of time.

For example, the increasing popularization of the "peak oil" theories and predictions of approaching resource exhaustion have been around for a long time without initiating a price explosion. Now, they are cited regularly to justify or explain price increases. Why is more attention now paid to "peak oil" theories or to the so-called end of the Saudi oil miracle than was the case only three or four years ago? The reason is, in my view, the US occupation of Iraq and a generalized anxiety that oil supplies from the region are less secure than in the past.

Concluding Remarks

To conclude, I believe that the current market is supported by unsustainable foundations:

- The market will continue to levitate as long as the "shortage" mentality persists and the ongoing geopolitical tensions are not eased.
- Market levitation cannot, however, last forever: when, inevitably, demand growth moderates, production capacity expands and refinery "bottlenecks" recede, the consensus will swing in the opposite direction.
- Prices will decline in the medium term, perhaps abruptly because self-fulfilling prophecies can work in both directions. However, prices are not expected to return to levels anywhere near the old $20/B norm because "the era of easy oil is over".
- It is difficult to say when the reversal will occur. The moment to watch for is when a wider consensus is reached between producers, consumers and analysts that "high prices are here to stay". We are not there yet but we are getting close.
- When, inevitably, signs of a downturn begin to emerge, OPEC will probably attempt to engineer a soft landing towards the $40-50/B range. But, in view of the dominating influence of the futures market, it remains to be seen whether the Organization will be able to stem the price correction anymore successfully on the way down than it did on the way up.

A SOMEWHAT UNFRIENDLY LECTURE ON ELECTRICITY DEREGULATION

*by Ferdinand E. Banks**

About a month ago Professor David Newbery of Cambridge University paid Uppsala University a visit in order to act as discussant on a monograph about electricity pricing. Although this is not the place to go into the details of that seminar, I was left with only a few minutes to introduce Professor Newbery and his audience to my side of the electricity deregulation (i.e. *restructuring*) quandary.

Unfortunately, things did not work out as I planned, because I committed the gross error of making a simple transaction complex. What I should have emphasized, and without prologue, is that electricity deregulation has failed, is failing, or will fail everywhere. The examples that I use in my work are California, Montana and Texas in the United States; Alberta and Ontario in Canada; Brazil, South Australia, Sweden, and to a lesser extent Norway, New Zealand, and the UK. Here I can note that only a year or so ago, Texas was referred to as the most successful deregulation exercise in the U.S. – or maybe the world. As things now stand, the average electricity price in 'the lone-star state' is the highest in North America. I would also like to take this opportunity to mention the situation in my former home state, Illinois, where as things stand consumers can look forward to an increase in electricity prices of at least 30 percent in 2006, as a result of agreements that were entered into when deregulation was launched.

What do I mean by failed or failing? When the concept of deregulation was first introduced, the promise was for lower prices and higher or unchanged reliability, all of which would be served up against a background of increased 'choice' for households and businesses. My reaction here was, and is, straightforward: according to the economics and finance that I teach, and the engineering that I briefly studied and practiced, there would not – nor could not – be anything resembling lower prices or unchanged or higher reliability. As for increased choice, we have been permitted to enjoy that in Sweden, but what difference does it make when it is impossible to avoid an increase in electricity prices that is considerably more than twice the consumer-price inflation rate. (This business of the increase in the electricity price vis-à-vis the inflation rate will be mentioned later.)

Now for a little economics. Suppose that I was partial to deregulation, and was given the opportunity to clarify for the television audience why electricity deregulation was even more beautiful than love's young dream compressed to a video clip. I would start by dramatically insisting that every economics textbook in the world spells out in detail the advantages of a wider and more thorough competition (or what on the electricity scene has come to be called liberalisation, but which in both cases means restructuring). What I would avoid saying is that this story-line appears in the first part of these books, while in later chapters – which both students and teachers often fail to read – there is a detailed explanation of why it doesn't work in the case of industries like electricity and gas. In non-technical but unambiguous language, this reduces to the following:

1) The inability to establish the kind of competitive arrangements found in the first part of your favourite textbook. This is due, for the most part, to increasing returns to scale. The way this potentially embarrassing topic is usually handled by deregulationists is simply to deny that increasing returns to scale exist. As a matter of fact, it was a denial of this sort in the important publication *Business Week* that first brought my attention to the present topic, and in the words of a former colleague in Hong Kong, causes engineers to shake their heads when they hear economists talking about deregulation. I should perhaps mention that while some influential economists were able to accept *technical* increasing returns to scale in pipelines and power lines, they argued that there was a decrease in *economic* increasing returns to scale because of

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a fall in the demand for electricity and gas. This was perhaps the most defective reasoning of all.

2) Lack of investment in low cost capacity: the less the capacity, the higher the price, and depending on costs, the greater the profits and bonuses. This is perhaps why, in Sweden, the major power firms were so mild with their protests when the government announced plans to close two nuclear reactors. Moreover, the Swedish government is even more in favour of deregulation than the power companies, because when prices for an inelastic good like electricity rise, it increases their tax revenues. After all, a government that is systematically reducing health care for everyone from children to pensioners, as well as eliminating a range of other welfare amenities, is hardly inclined to be overly attentive to the price of electricity, particularly when one of their partners – the environmental party – feels that this price is too low.

3) As pointed out at one time by many deregulationists, and correctly, for deregulation to be successful, adequate facilities must be available for hedging the price risk that accompanies deregulation. These facilities are *not* available, and as suggested below, they are unlikely to appear. Furthermore, it could be argued that even if governments and firms had the best will in the world where boosting investment is concerned, it can be shown with some mainstream neo-classical economics and elementary mathematics that (*ceteris paribus*) uncertainty decreases physical investment. This situation is constantly referred to in the business press.

4) Deregulationists say that electricity price risk/uncertainty can be hedged on conventional derivatives (e.g. futures and options) markets of the kind that function excellently for various commodities and financial assets. As we found out in California – and especially New South Wales (Australia) – the electricity market is different. In fact, there is a simple way to approach this difference. Professor Lennart Berg teaches financial economics at Uppsala University, and he has about 100 finance books of all types in his room. Every new book that is published on this subject comes to him. I have examined at least half of these books and estimate that there are probably less than five pages on electricity and gas derivatives in all his books, or for that matter all the finance books in the Uppsala-Stockholm region. Five pages out of tens of thousands of pages. What none of them bothers to make clear is that the most important derivatives exchange in the world, NYMEX in New York, delisted its electricity contracts several years ago, and at least one of its gas contracts. They may, of course, have reinstated these in one form or another, because the memories of many people who lost money in those markets are short, and neither the persons who use or write about platforms of this type are prepared to admit that in theory it would be in the interest of almost every household and business on the buy side of the electricity market if the serious fraud squads were reinforced and given *carte blanche* to find out just why electricity deregulation, and electricity derivatives (and the exchanges specializing in them) came into existence, when these superfluous enterprises are clearly detrimental to the interests of consumers and small business, as well as energy intensive large industries.

An interesting situation has now appeared in France, where the government has just announced that it will partially privatise Electricité de France (EdF). The first two points above are explicitly recognized, because there is a promise of investments of at least 40 billion euros during the coming 5 years, presumably in capacity expansion; and in addition the electricity price during that period will not be allowed to increase by an amount greater than the inflation rate. Since the government is keeping 85% of EdF, this should be comparatively simple to arrange, although at the present time the eventual scope of this liberalisation departure is not easy to discern. One hopes, however, that it has something to do with reducing the very high unemployment rate in that country, which is something that the Swedish government has visibly failed to do with the large tax receipts that it gained as a result of deregulation.

More of the Same Medicine

Not too long ago a senior executive of the Nordic Electricity Exchange (NORDPOOL), Mr. Erling Mork, questioned my motives and competence in describing the activities of his organization (2004). In some ways he was correct in doing this, because the only real insight that I possess into NORDPOOL's activities is that they severely disadvantage electricity consumers: I am alluding here, of course, to the short-run marginal cost pricing practiced by that establishment. This results in some of the most inexpensive electricity in the world cost wise, being frequently sold at the price of some of the most expensive in Europe – e.g. that of Denmark and Germany. As pointed out above, these high prices make it possible for the Swedish government to obtain (via the tax route) many more billions of (Swedish) crowns than e.g. the approximately 12 billion they will acquire this year due to their ownership of the enormously profitable firm Vattenfall. In case readers are interested, most of this cash will be used to pay the annual membership fee in the European Union, and *not* to bolster the sagging welfare system.

Just below that accusation was another defence of electric liberalisation by a gentleman from New Zealand, Mr Tony Baldwin. He took it upon himself to assure interested readers that in New Zealand – and presumably elsewhere – electricity restructuring is essential in order to "improve economic and environmental performance." As in the case of Texas, I once heard someone call New Zealand deregulation the best in the world, and according to Baldwin none other than Professor William Hogan of Harvard University ostensibly went so far as to say that "…the New Zealand electricity market design has been at the forefront of best practice," involving as it did "extensive consideration of the experience of other countries."

I am certain that Professor Hogan means well, but as far as I am concerned, New Zealand gave no consideration at all to the experience of other countries, because there was hardly any to examine when it launched its deregulation "experiment", as it was often called at that time. Instead, the deregulators in that fair land focussed their attention on the large domestic supply of natural gas, whose price – by one means or another – was kept below the scarcity/free-market level in order to ensure the blessings of deregulation. As things often happen, that large supply has become small, which makes it likely that NZ gas buyers are going to find out that despite Professor Hogan's *bona fides* and enthusiasm, the standard deregulation model is the antithesis of what Mr Baldwin mistakenly feels is an outlet for "efficient investment in new generation." An author who has gone to great trouble to point this out is Professor Reinhard Haas of Vienna's Technical University, and in my journeys I never miss a chance to repeat as often as possible that deregulation increases uncertainty, which in turn leads to a decline in physical investment. Strangely enough, many economists make a point of ignoring this phenomenon, which is perhaps the most important aspect of deregulation.

Baldwin also informs us that a high price volatility is an inherent part of an efficient electricity spot market. In his words, "it is not a flaw." Instead, the flaw is in failing to hedge against it.

This sounds right, but it happens to be wrong. It is wrong because there isn't an exchange in the entire world capable of providing optimal hedging volumes for electricity. The main reason is because the volatility being confronted is not just high, but extreme, and as a result the speculators who are essential for generating liquidity have been burned so often that they prefer less risky commitments. While speculators are gamblers, those who survive become experts in picking up the right signals. In France, however, this matter of hedging the price risk may initially turn out to be irrelevant because of the structure of ownership, although as (or if) greater amounts of EdF are privatised, it will have to be considered. On the other hand, it is useful to note that at least one presidential candidate, Laurent Fabius, has promised that if he takes command in France, EdF will be deprivatised.

Mork also notes that *contracts for differences* (i.e. swaps) have a "special role in the Nordic market." I can certainly agree to that, but although I make an attempt to provide an introduction to swaps in my finance book (2001), I am unable to comprehend any idiosyncrasies of NORDPOOL other than those which have to do with creating a system that will boost the incomes of owners and employees. That operation has utterly failed to help promote the lower electricity prices that the television audiences in many countries were promised when deregulation was introduced.

And worse is to come, because as Braconier (2005) notes, another dark cloud in the

Swedish heavens is carbon dioxide 'emissions trading', which will also very likely be managed by NORDPOOL. Swedish hydro and nuclear electricity generation is essentially free of carbon dioxide, but not all large firms are so fortunate, and so their costs will be increased. In addition, the trade of emissions 'rights' on the continent, where hydro and/or nuclear resources are scarce in most countries, will (*ceteris paribus*) increase the price of electricity in that region, and (via NORDPOOL) this will impact on the price of electricity in Scandinavia.

One more observation is necessary before going to the conclusion. I'm mostly concerned with the fate of consumers under deregulation, but in the middle of October the managing director of one of the largest firms in Sweden (SCA) said that his firm would not be making a planned major investment because of the high price of electricity. Somewhat earlier, the directors of other large industries stated that they will form a syndicate in order to purchase electricity from countries in East Europe.

This is extremely interesting, because what deregulation has done by raising electricity prices is to partially eliminate the traditional and highly advantageous comparative advantage that Sweden has enjoyed in some of its major export activities over the past 40 years. I'm especially thinking of the industries for processing forestry products. If the present situation is not remedied, these firms will not only cease to invest, but eventually move everything movable out of the country, and Sweden will find itself with the kind of unemployment and social problems that were unthinkable just fifteen years ago. There was a time when Swedish politicians would have understood this, but that was before their judgements were corrupted by dreams of high-paying, tax-free non-jobs outside this country, although I won't mention just where.

Some Concluding Remarks

An hour after the conclusion of Professor Newbery's presentation, I found myself staring at a full page 'Comment and Analysis' in the *Financial Times*, with the title 'Power Struggle: Britain's Battle To Adapt It's Liberalised Energy Market To A New Climate' (October 6, 2005). Journalists are often more alert about these matters than charter members of the deregulation booster club, however they have their shortcomings too, and so a number of important issues that should have been investigated were overlooked. But there were two important observations. The first was that domestic electricity prices in the UK have increased by more than 30 percent since the start of 2004, while gas prices have increased 35 percent over the same period, with "further increases" on the way.

There was also some reference to the future use of gas by the UK, and somewhere in the exposition it was noted that Goldman Sachs predicts a 'gas glut'. This sounds to me like the kind of wishful thinking that took place in New Zealand, where various misunderstandings and/or expectations about the availability of natural gas led to electricity deregulation being painted in brighter colors than was warranted by the facts. Although not certain, I suspect that any country that becomes as heavily dependent on gas, as is forecast for the UK in that article, is riding for a fall.

When all is said and done, the most important question associated with the electricity deregulation farce is "How did it happen?" An outstanding source of non-technical energy information is EnergyPulse (www.energypulse.net), and as one of their commentators said about the U.S., there is absolutely no evidence that consumers had anything to say about the introduction of deregulation, nor do a large majority want any part of it. But somebody must be guilty, and not just decision makers or movers-and-shakers!

A few years ago a behavioural economist gave a talk in the economics department at Uppsala University, at the end of which I informed him that as long as I was allowed in that building, behavioural economists would find it difficult to ply their trade. But it's likely that I was wrong. The empirical side of their work fails to impress me, but behavioural economists may be correct in asserting that a very large number of people are burdened with a hardwired lack of self-control that prevents them from making rational decisions in crucial matters. I woke up to this phenomenon during my last year in the army, although gradually I came to the conclusion that it could be attributed to carelessness. The kind of unthinking carelessness that often – but not always – leads highly literate persons with excellent analytical capabilities to behave irrationally, and to

make or support decisions like electricity and gas deregulation that are completely out of step with their best interests.

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